

Semester Long Activities (Project/presentation etc.)

PROJECT – OS KERNEL SIMULATION

Points: 100

Weightage: 10%

Description:

This project aims to provide basic understanding of operating system kernel development. In this project, you have to build an operating system's kernel simulation. It is divided into different phases. Each phase will be evaluated separately. Most of the phases are dependent on the predecessor phase, so be careful to implement each phase on time. Each phase has its own weightage, in terms of points. Last phase is a bonus and points gain in it will be in addition to total points. You can make additions or some change but with the consent of the instructor.

General Instructions:

- For this project you must choose a programming language, which provides convenient graphical user interface. For this purpose, you can choose Java, Visual Basic, C Sharp or any other visual language.
- Remember to keep the program logic separate from the interface code.
- For each phase you must submit both the hard copy and the soft copy to your instructor.
- For each phase development there will be demonstration on computer.
- Each phase deliverable is due after one week of announcement.
- Late submission will result in deduction of 25% for each day.
- No deliverable will be accepted after 2 days of due date.
- Any student found in guilty of copying/code exchange will be awarded F grade. In this case, both the students who found guilty in exchange will suffer

Project Plan:

Phase-1: Control Panel and PCB [30 points]

Task-1.1: [15 points]

First of all, you have to give a name to your operating system. Then you have to build a control panel for operating system simulation. In the main page of simulation there should be buttons for following operations;

- Process management
- Memory management
- I/O management
- Other operations

Then you have to create Process Management menu. In this menu, you have to create buttons for the different operations that can be performed on a process. These operations are following:

Operations on a Process related to Process Management

- Create a process
- Destroy a process
- Suspend a process
- Resume a process
- Block a process
- Wakeup a process
- Dispatch a process
- Change process priority
- Process communication with other processes

There should be a configuration button which opens the configuration menu. From this menu, you can set some environment parameters of kernel.

Task-1.2: [15 points]

In this phase, you have to develop a Process Control Block for each process. In this phase you have to just create attributes of process held by PCB. You have to generate only process ID.

Process Control Block (PCB) will contain following information:

- Unique identification of the process
- Current state of the process
- Owner of the process
- Process's priority
- A pointer to the process parent
- Pointers to process's child processes
- Memory requirements
- Pointer to allocated memory
- The register save area – CPU register
- The processor it is running on
- I/O state information

Phase-2: Process scheduling [30 points]**Task-2.1: [10 points]**

In this phase, you have to develop a scheduler. This scheduler will include all the three levels of scheduling, i.e., high level scheduling, medium level scheduling, and low-level scheduling.

Task-2.2: [10 points]

In this phase, you have to actually simulate the processes on First Come First Server (FCFS) basis. At one time only one process should be in running state. You have to provide and manage other states of process and queues.

Task-2.3: [10 points]

In this phase, you have to employ a scheduling algorithm other than FCFS. You have to also show all the queues in the system, i.e., ready queue, block queue etc.

Phase-3: Memory Management [20 points]**Task-3.1: [10 points]**

In this phase, you have to perform paging. For this purpose, you have to allocate memory to a process and according to that memory requirement you have to create pages for that process. The page size should be read from a file containing information about page size. This page size can be set from configuration menu.

Task-3.2: [10 points]

You have to also employ page replacement algorithm. Implement the LRU page replacement algorithm.

Phase-4: Synchronization & IPC [20 points]**Task-4.1: [10 points]**

In this phase, you have to perform synchronization and resource sharing. You have to employ concept of cooperating processes, critical section and mutual exclusion. Resource sharing must be done using semaphores or monitors.

Task-4.2: [10 points]

In this phase, you have to provide some mechanism for inter-process communication. You have to facilitate sockets, remote method invocation (RMI), message passing and shared memory.

Bonus Phase: Distributed OS [20 bonus points]

In this phase, you have to turn your kernel into a distributed kernel. You have to construct client/server architecture. You have to make your OS as a server operating system. On this Server OS, you can create processes remotely from another computer. For this purpose, there should be a mechanism on control panel of your client OS from where, you can send a process remotely to a server.